4th SuperB Collaboration Meeting – May 31st / June 5th 2012 – La Biodola (Isola d'Elba)- ITALY

D^0 Reconstruction and Vertexing

02/06/2012

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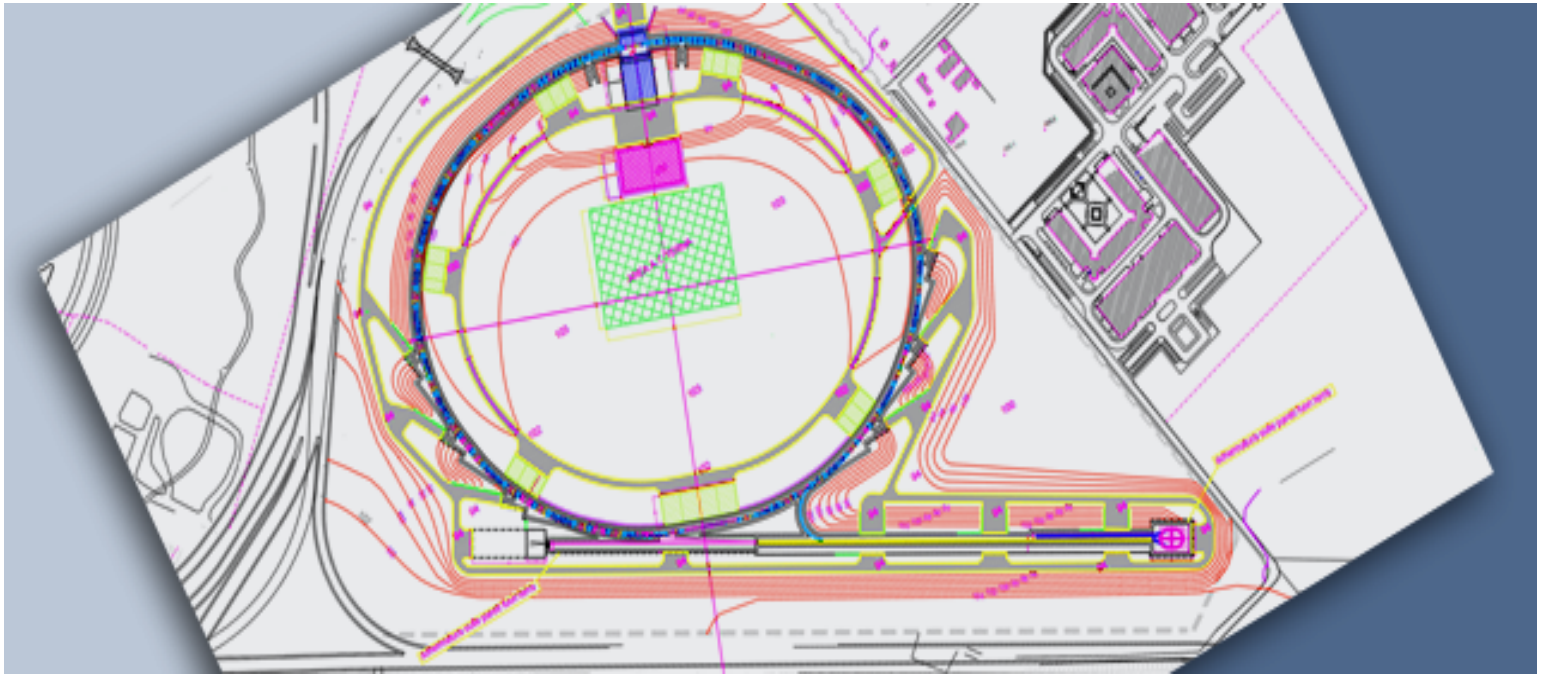


Queen Mary University of London

SuperB

CABIBBO LAB
Laboratorio Nicola Cabibbo

Outline

- A postcard
- Semileptonic Tag at charm threshold: strategy
  - $e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.56]$
  - *Masses Reconstruction – Cuts – Vertex Resolution – Δt Resolution*
- Hadron Tag at charm threshold
  - $e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+K^-)(\pi^+\pi^-)[\beta\gamma = 0.56]$
  - *Masses Reconstruction – Cuts – Vertex Resolution – Δt Resolution*
- Summary table
- Soft pion Tag at the Y(4S)
  - *B^0, D^*, D^0 Vertex Resolution*

- Next steps
- Another postcard
- Back up: charm threshold $\beta\gamma$= 0.28 , 0.9


A postcard to you from charm2012
Honolulu – Hawai'i
(...so, I did not come to Elba...)

Semileptonic Tag at charm threshold

Masses Reconstruction – Cuts – Vertex Resolution – Δt Resolution

$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)$$

- I generate the full chain using **FastSim V0.3.1** with **SL 5.8 (Boron)**
- The presence of the **undetected neutrino** does not allow a simple reconstruction of the semileptonic channel, however the information stolen can be obtained since we know the energy of the beam at the interaction point.
- It is possible to assign a **TIorentz Vector** to “what is stolen” and reconstruct the signals of interest (all..).
- The number of **misreconstructed** events can be well reduced by considering the property of two (correlated) quantities:

$$M_{bc} = \sqrt{E_0^2/c^4 - \mathbf{p_D^2}/c^2}, \qquad \Delta E = E_D - E_0$$

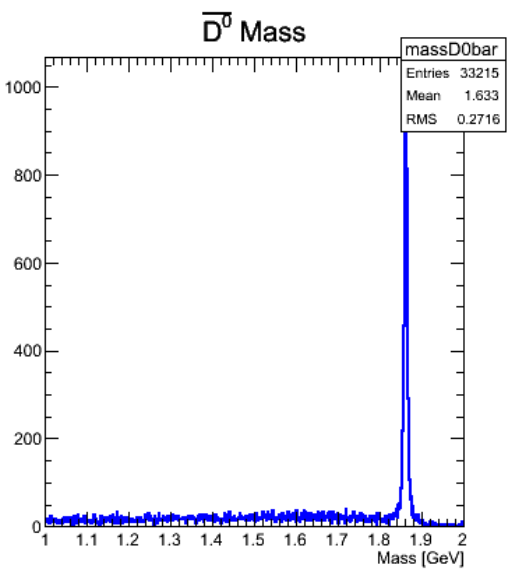
Half of the cms energy

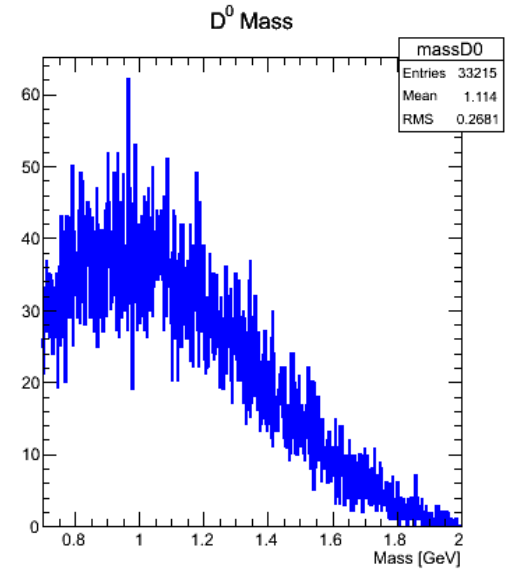
Momentum of the D candidate

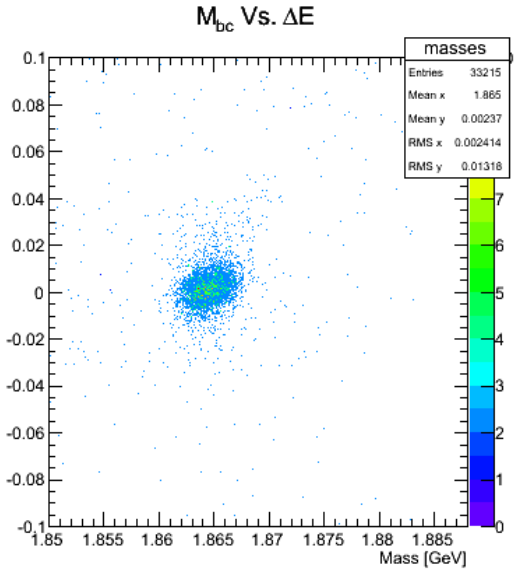
Energy of the D candidate

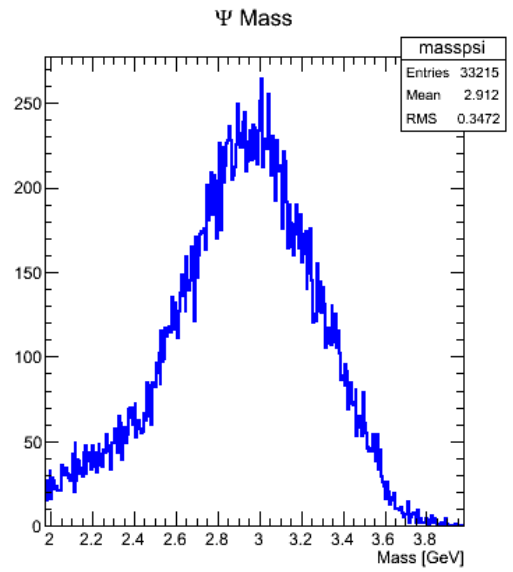
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.56]$$

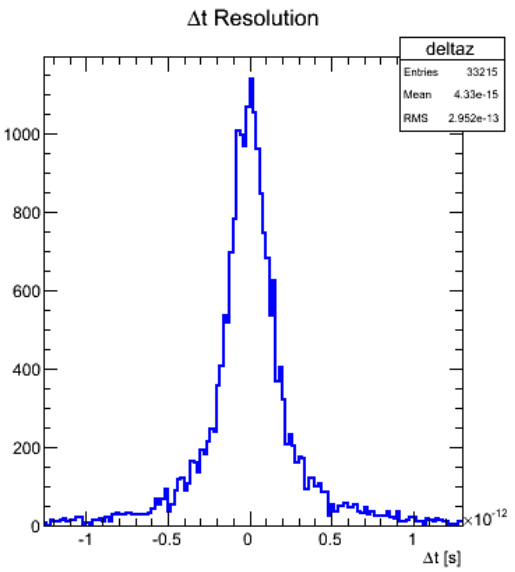
Missing ν + high background

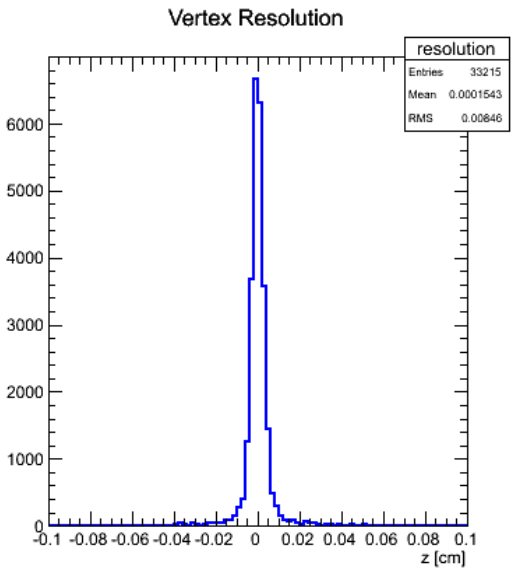






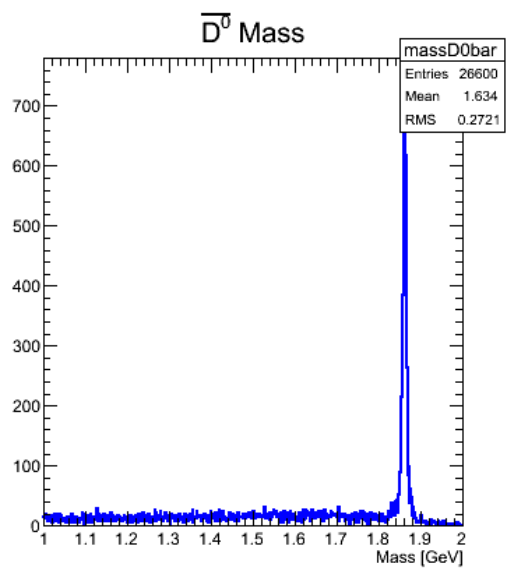


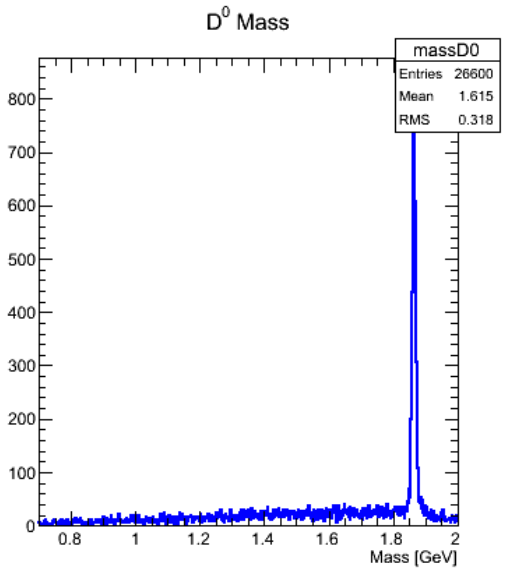


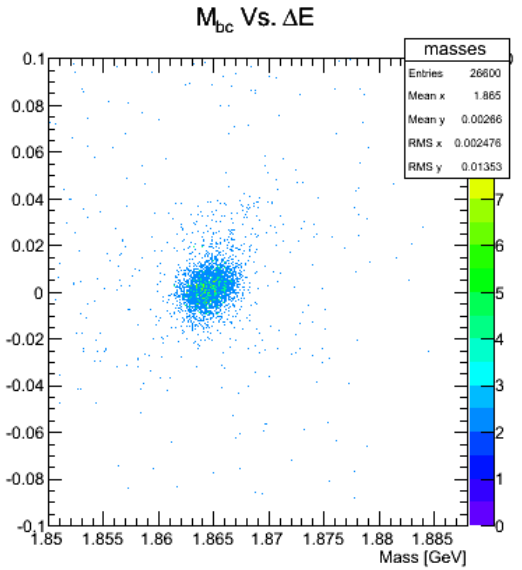


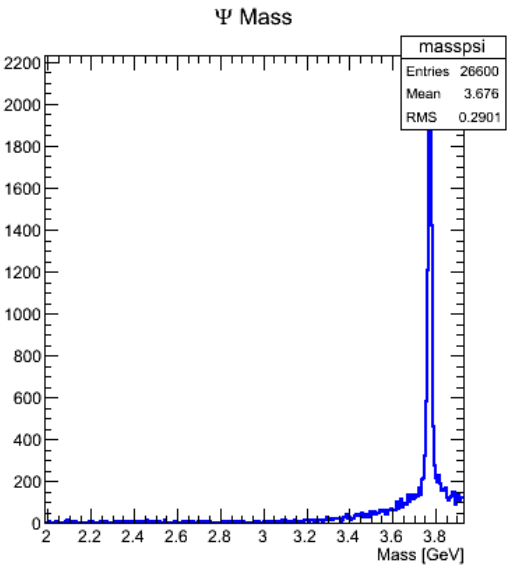
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.56]$$

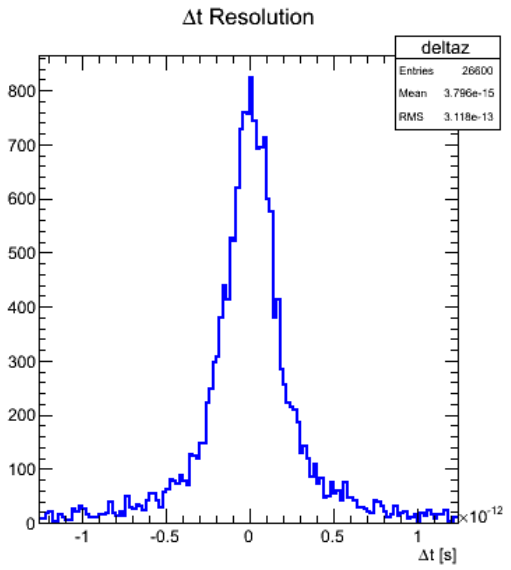
Missing ν reconstructed + small background

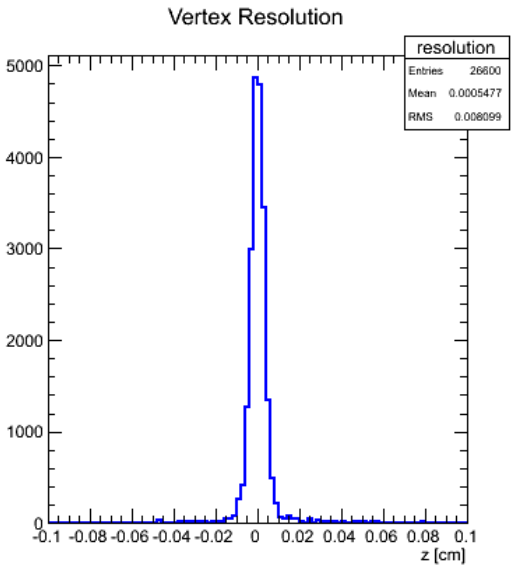








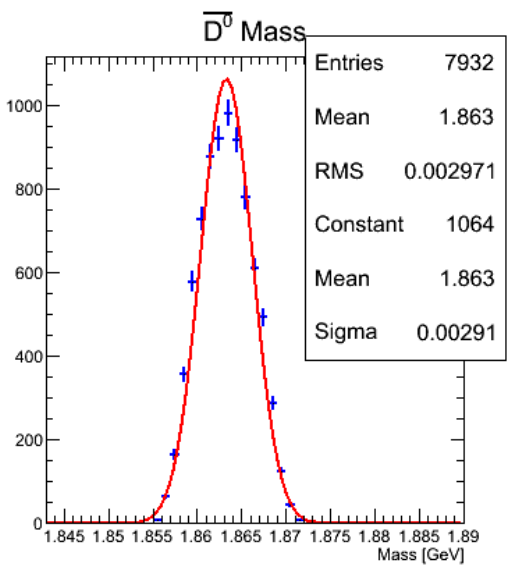


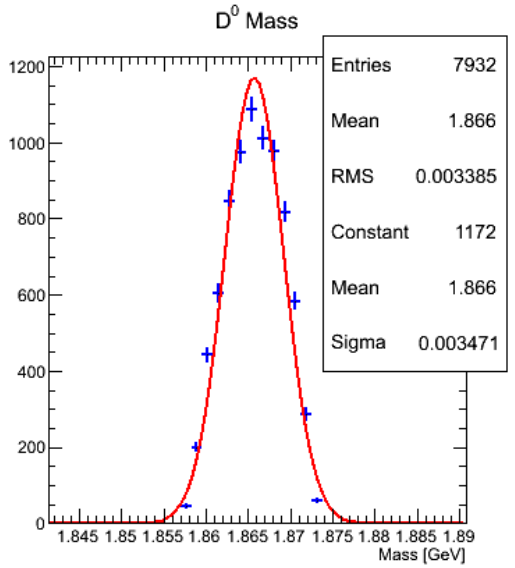


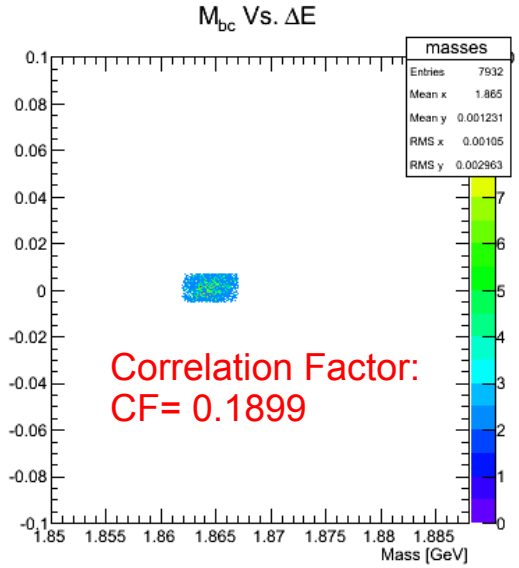
More in the back up slides

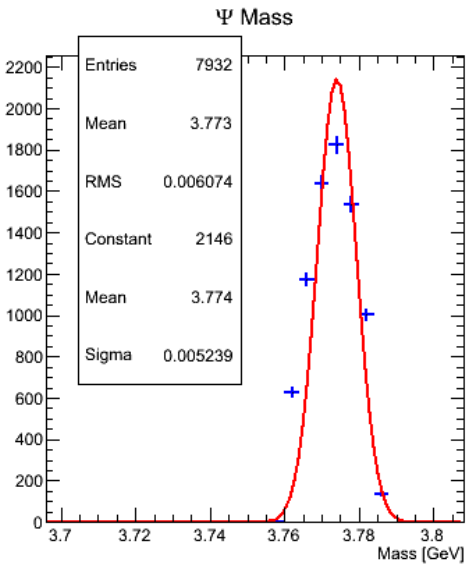
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.56]$$

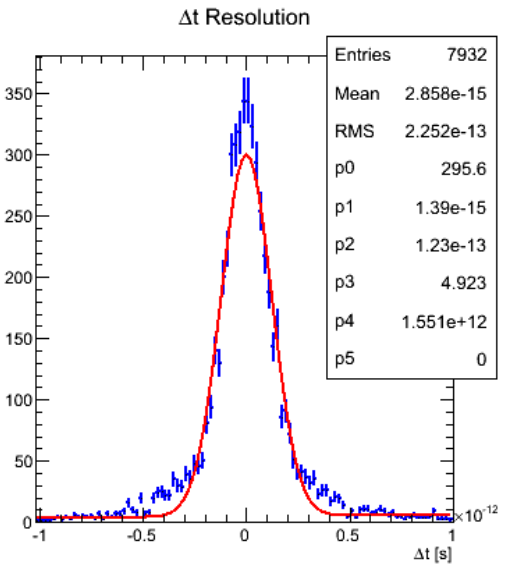
Missing ν reconstructed +clean

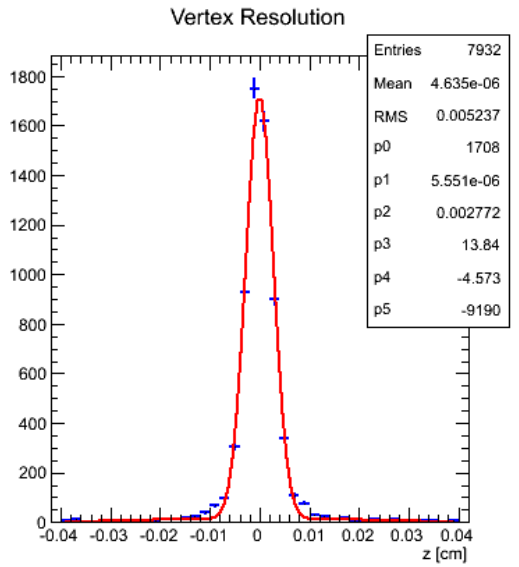










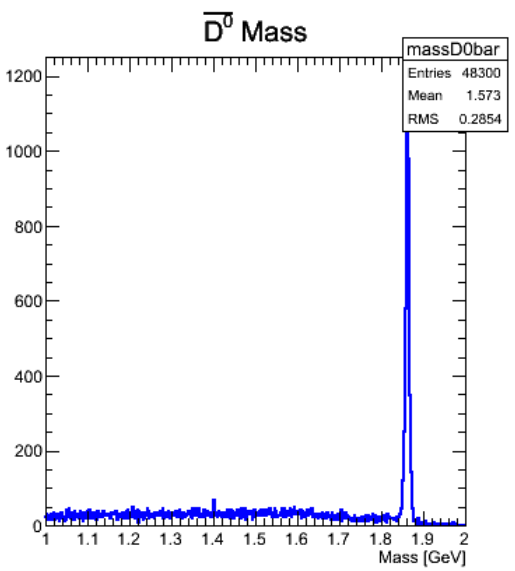


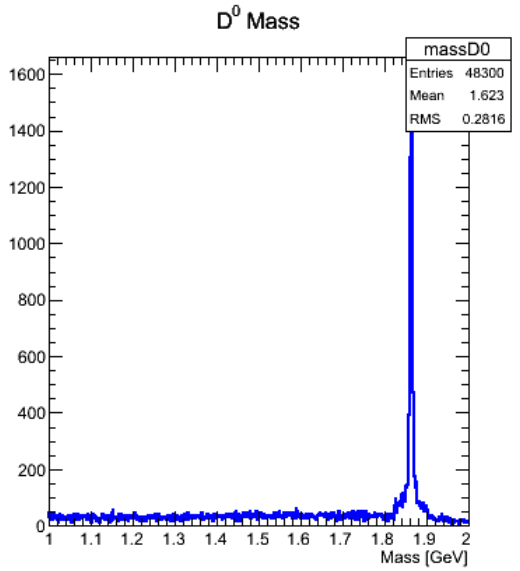
More in the back up slides

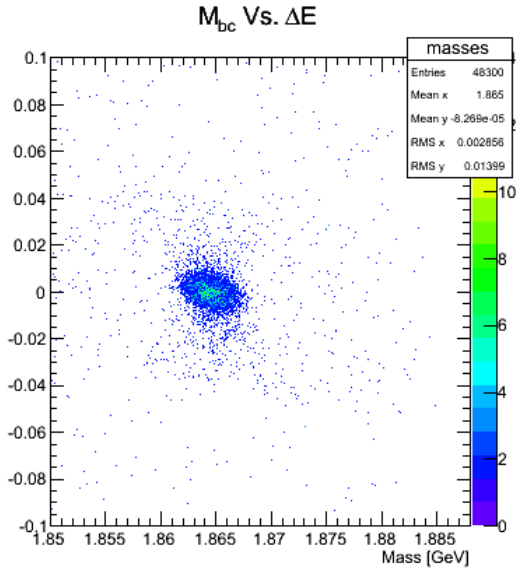
Hadronic Tag at charm threshold

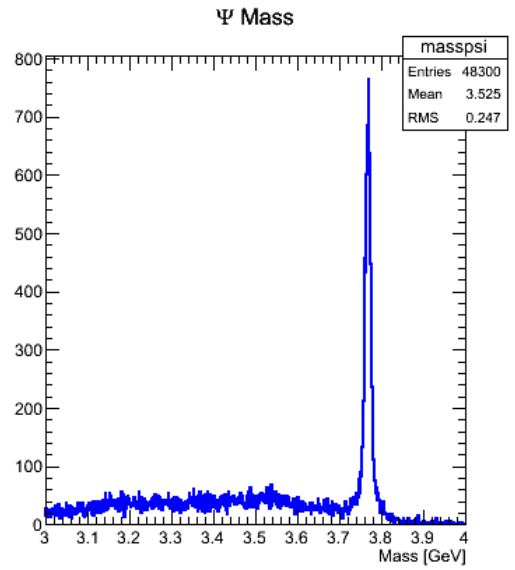
Masses Reconstruction – Cuts – Vertex Resolution – Δt Resolution

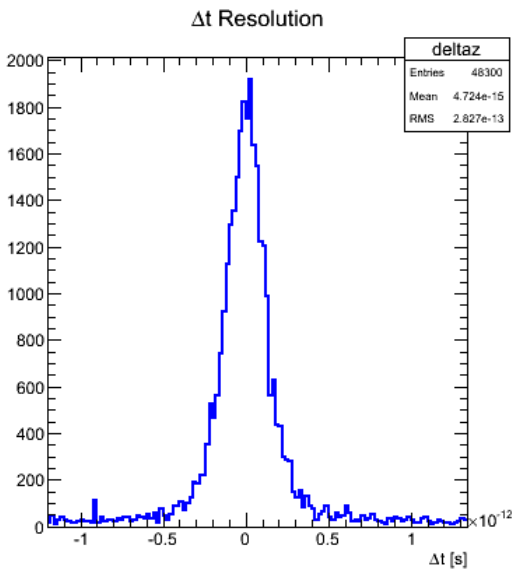
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+K^-)(\pi^+\pi^-)[\beta\gamma = 0.56]$$

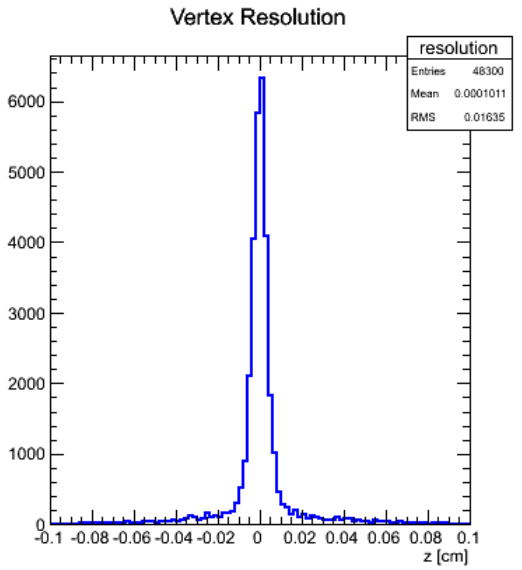












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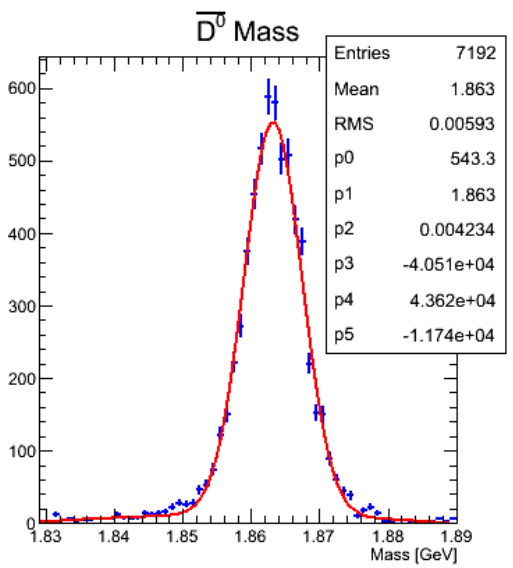
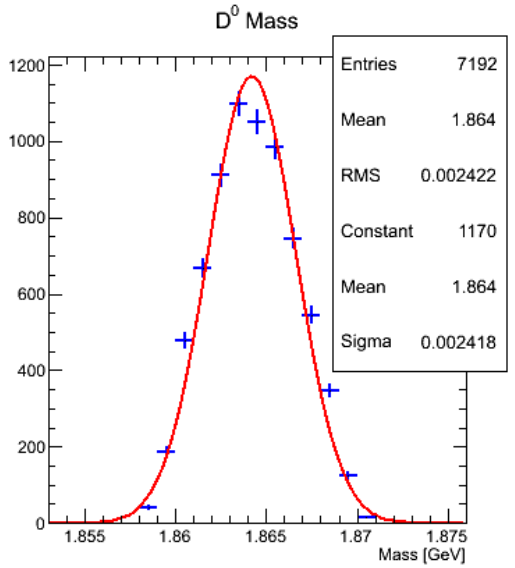
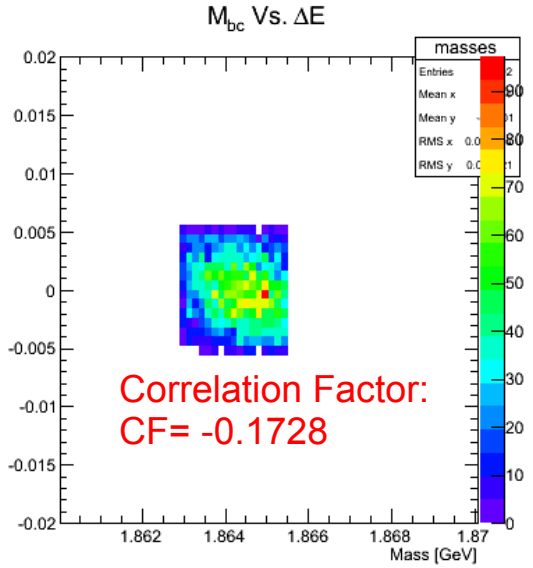
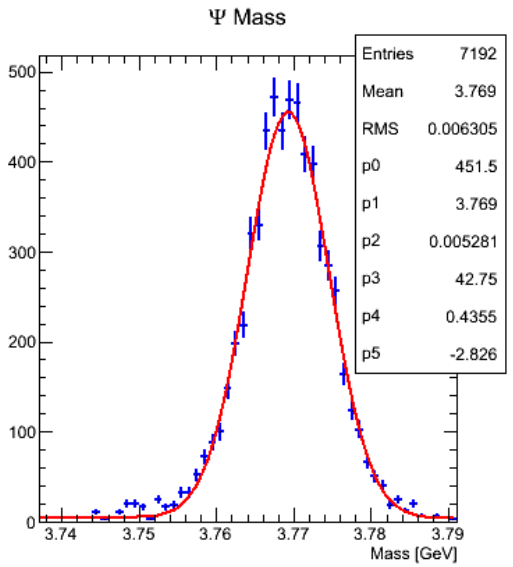
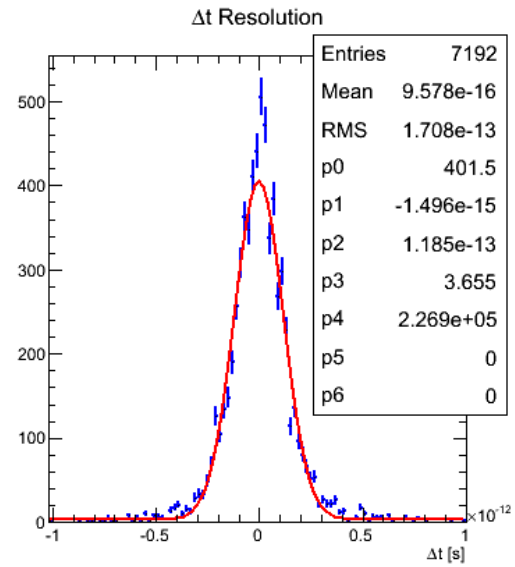
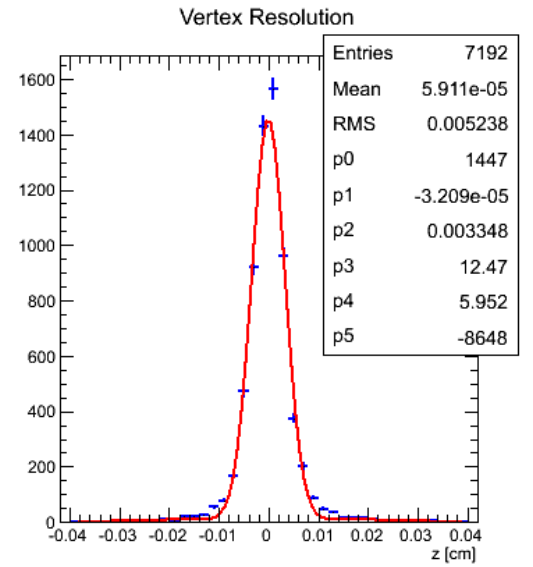






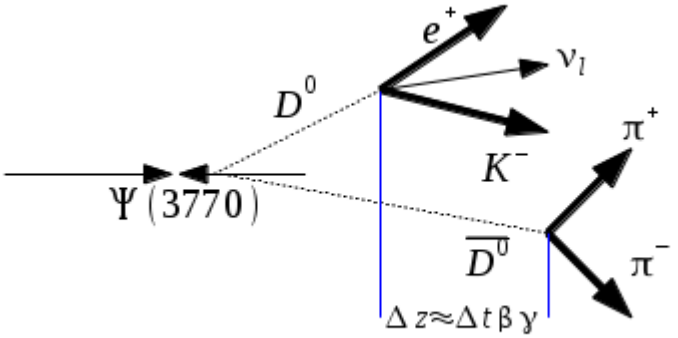


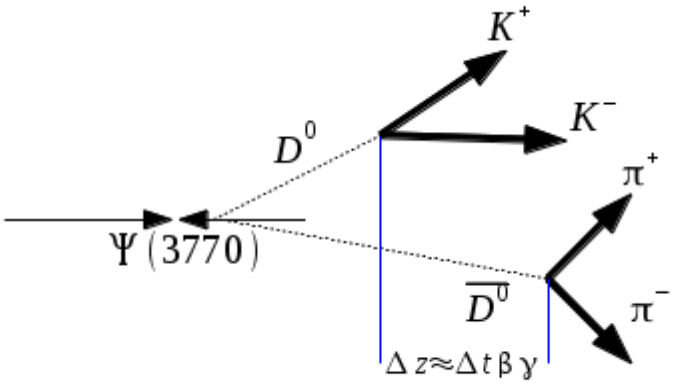




Fit Results Summary

Fit Results Summary





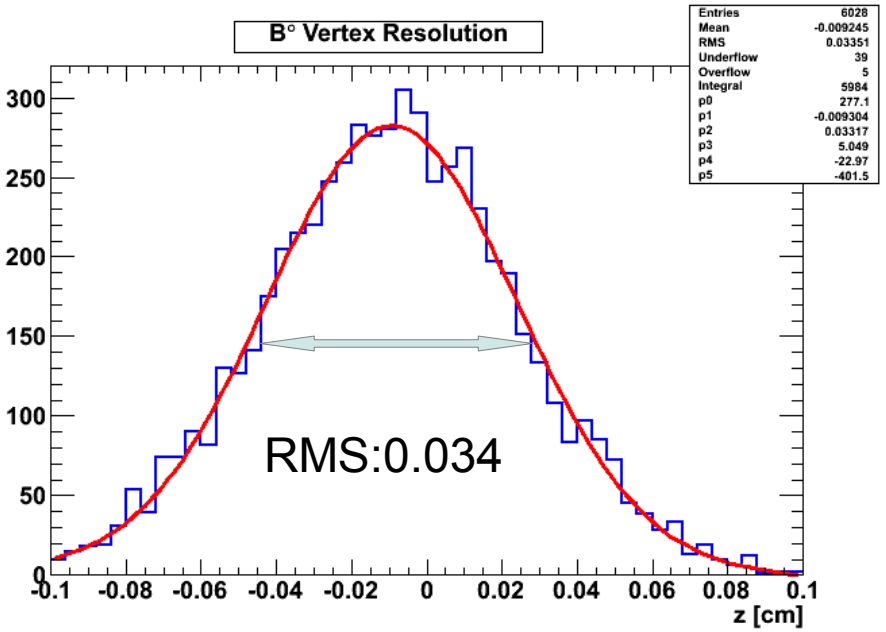
	Δt Resolution		
Tag/CP channel	Bγ=0.3	Bγ=0.56	Bγ=0.9
SL / ππ	0.36 (ps)	0.23 (ps)	0.24 (ps)
KK / ππ	0.23 (ps)	0.17 (ps)	0.19 (ps)
	Vertex Resolution		
SL / ππ	86 (μm)	52 (μm)	45 (μm)
KK / ππ	84 (μm)	52 (μm)	62 (μm)

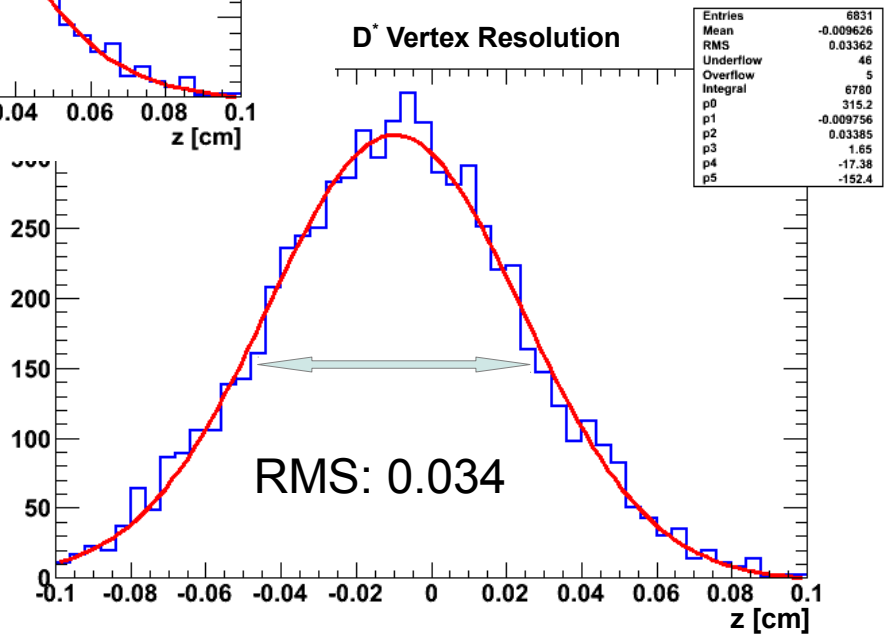
Soft Pion Tag at the $\Upsilon(4S)$

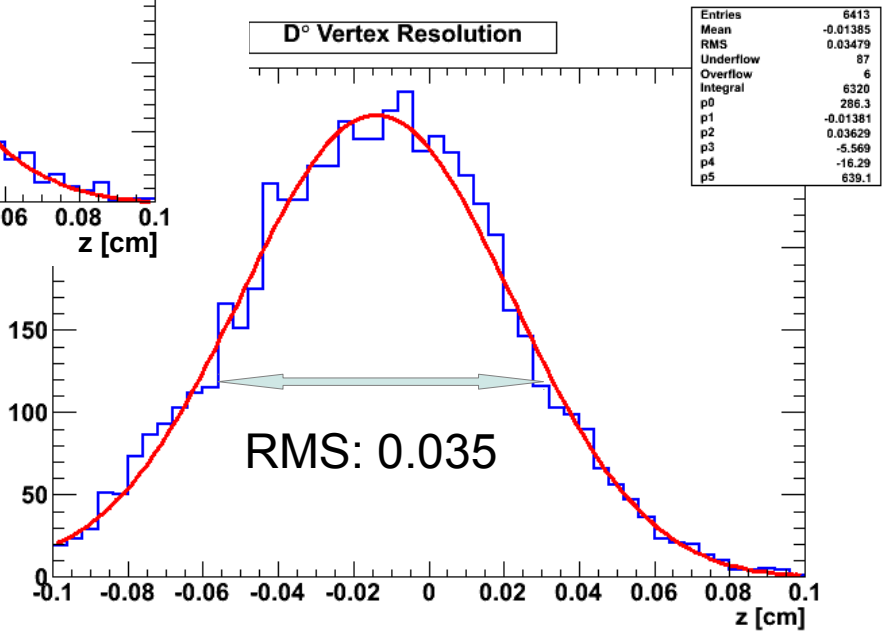
Masses Reconstruction – Cuts – Vertex Resolution

ONLY!!

$$e^+ e^- \to \Upsilon(4S) \to (B^0)(\overline{B^0});$$
$$B^0 \to (D^{*+} K^-); D^{*+} \to (D^0 \pi_s^+);$$
$$D^0 \to K^+ \pi^-$$







Comparison with BaBar performances and event reconstruction to come soon..

What's next...

- Perform the tag at charm threshold using also SL with muons.
- Evaluate the resolution at the Y(4S) and compare it to BaBar.
- Perform de/dx studies.
- Add background.
- Evaluate vertex performance in presence of background.
- It could be very useful go through a production of a few hundreds inv fb of data at charm threshold.

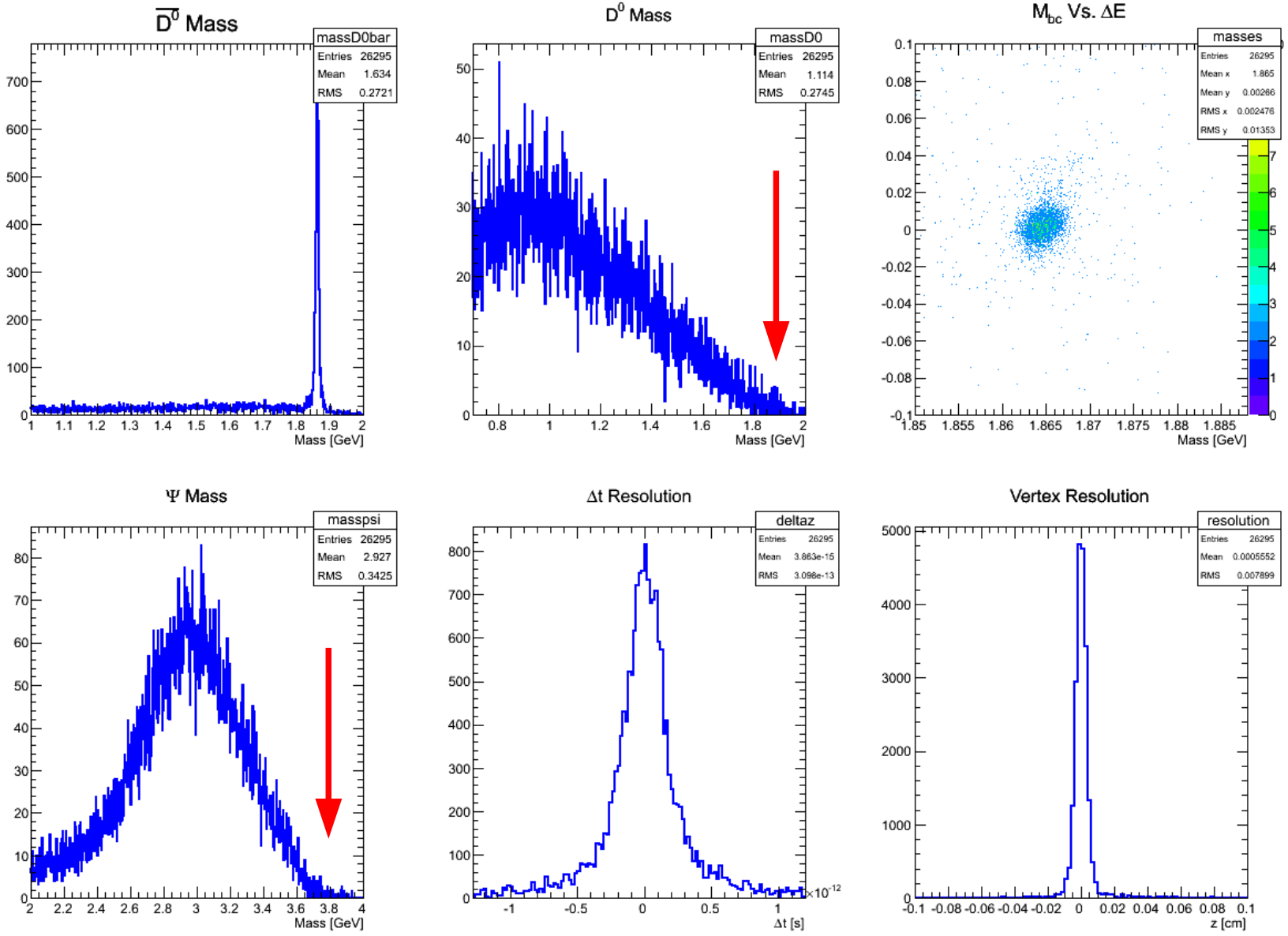
Many thanks and, just for balance, another postcard in the next slide...

...View from my office in London, yesterday...

Back up slides

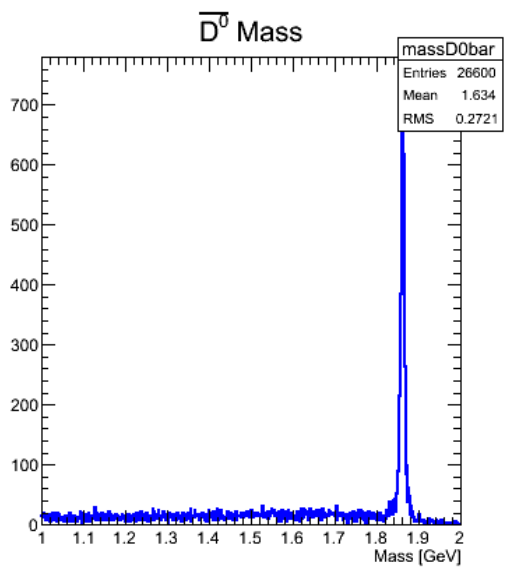
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.9]$$

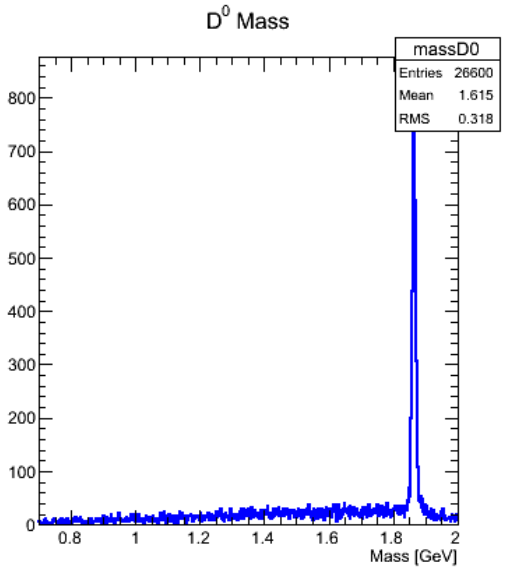
Missing ν + high background

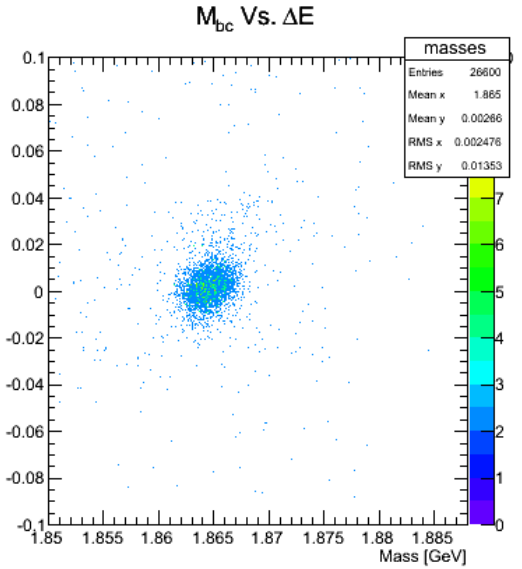


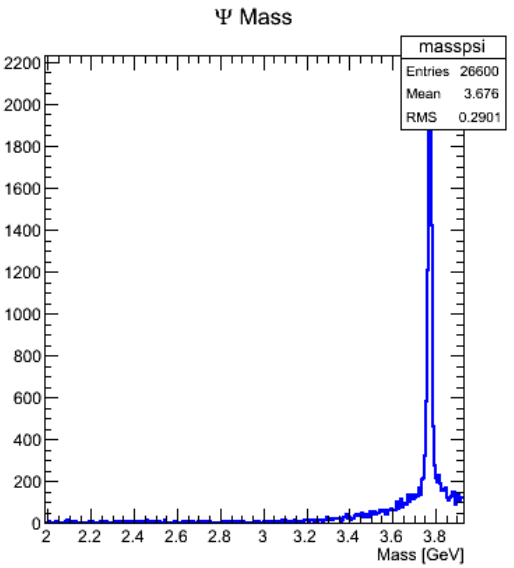
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.9]$$

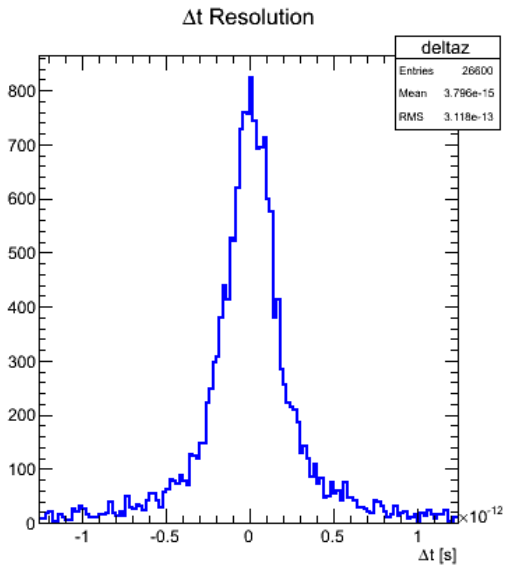
Missing ν reconstructed+ high background

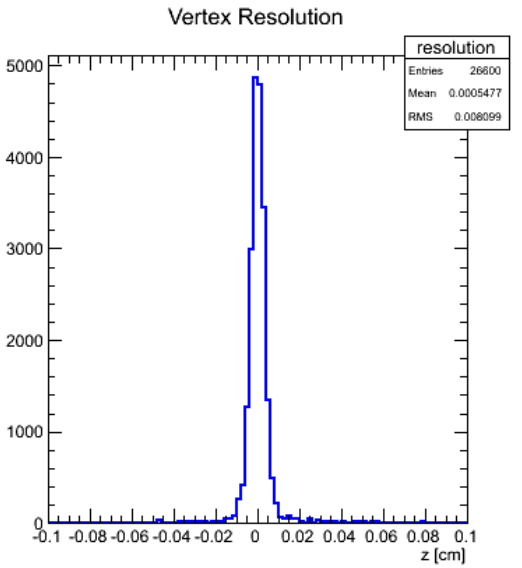






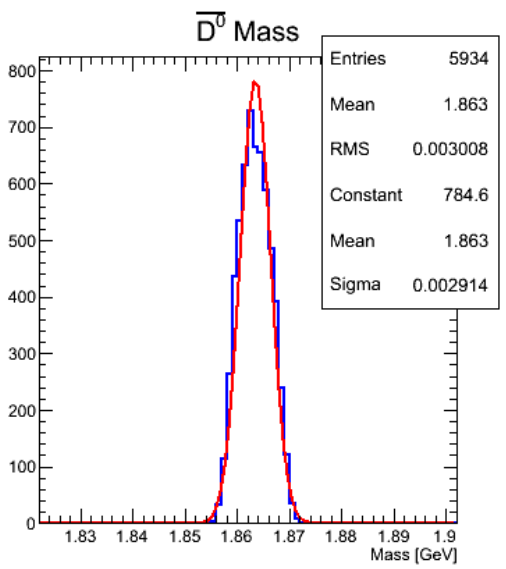


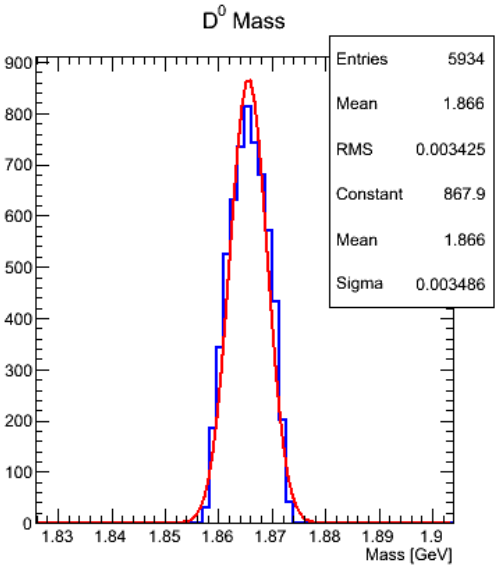


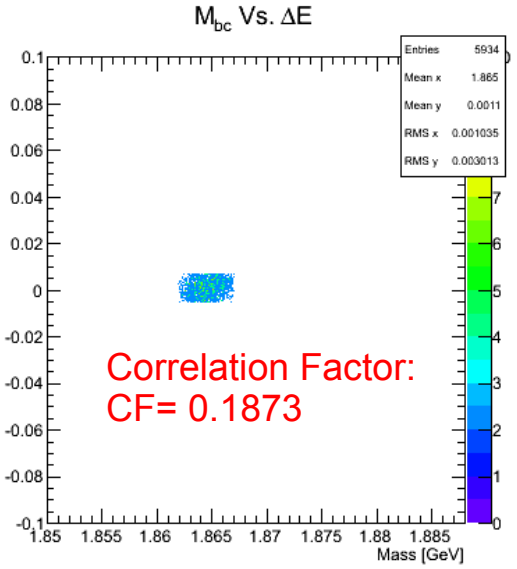


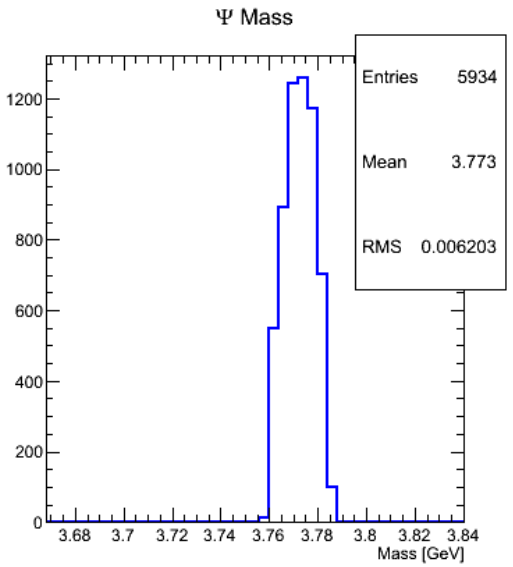
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.9]$$

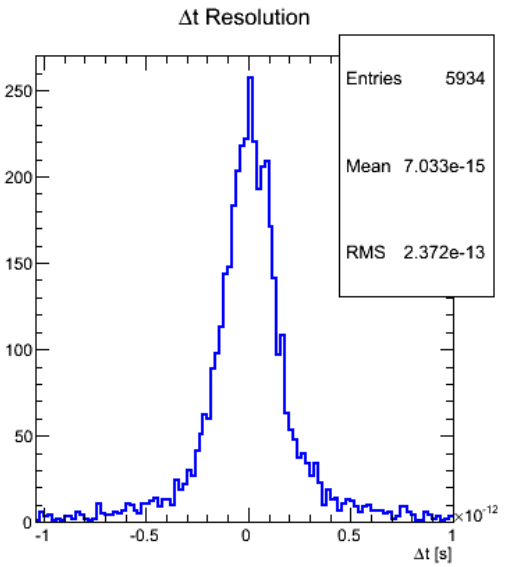
Missing ν reconstructed + small background

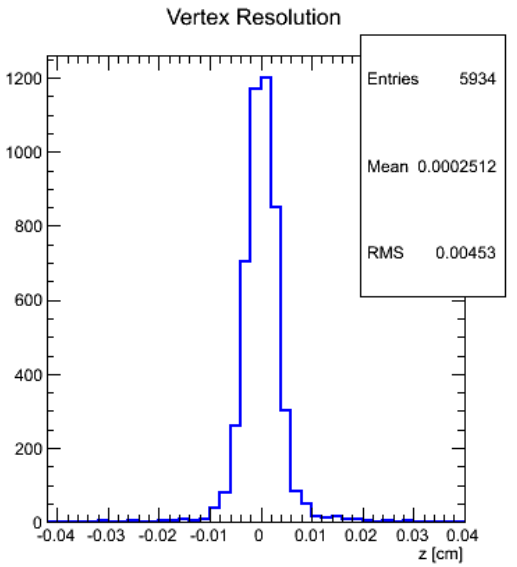






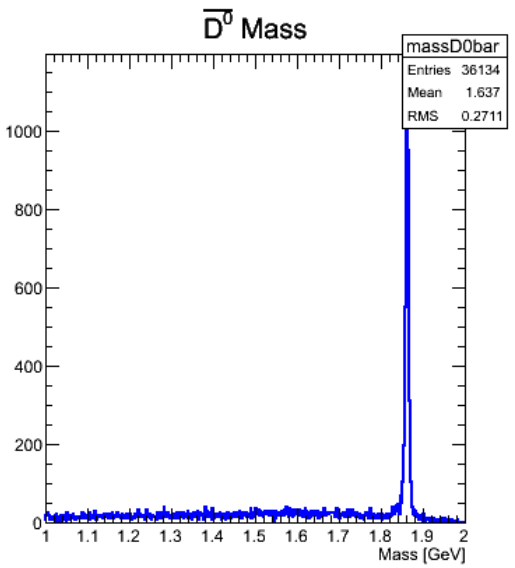


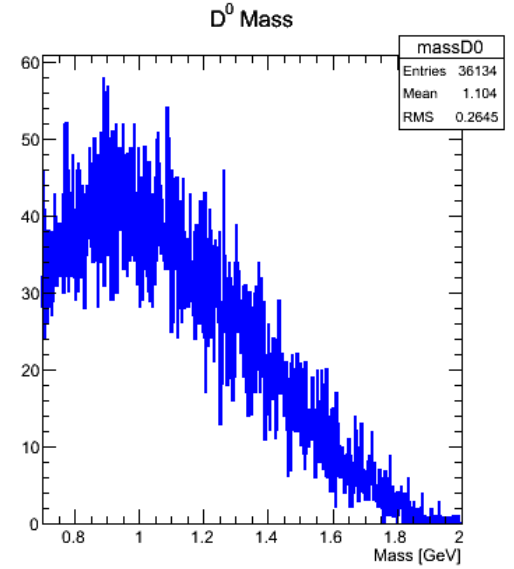


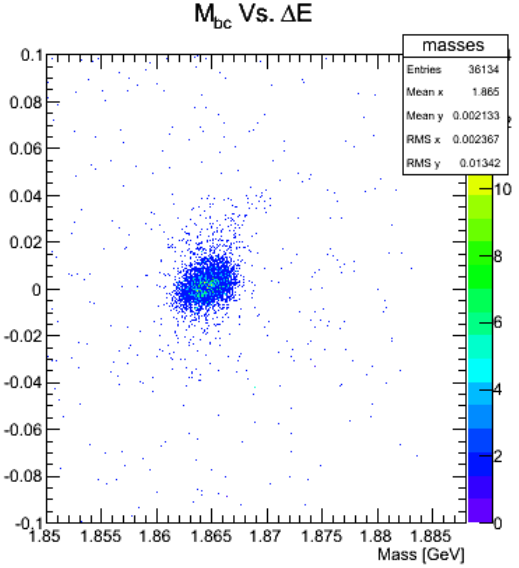


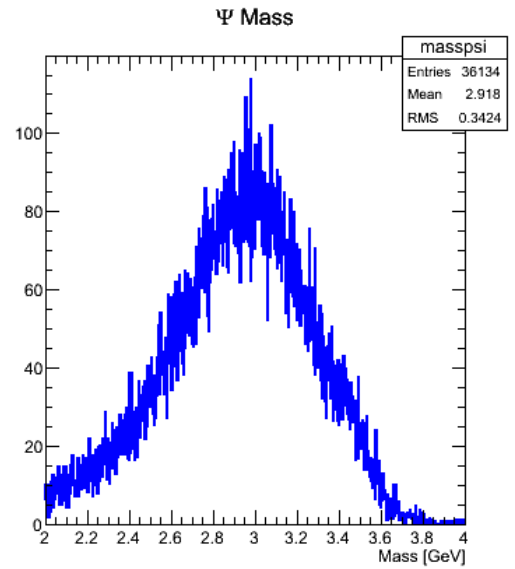
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.23]$$

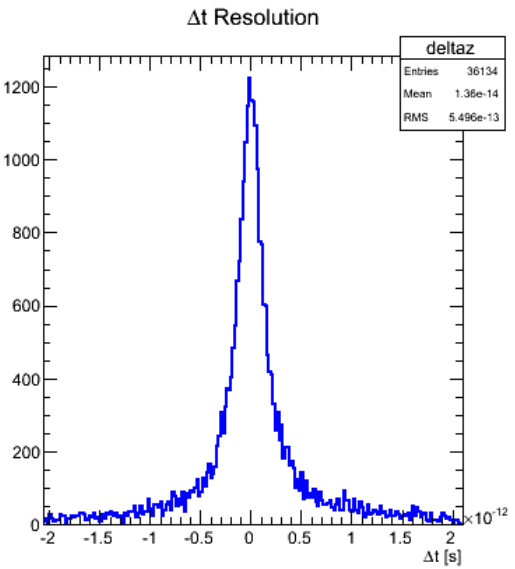
Missing ν + high background

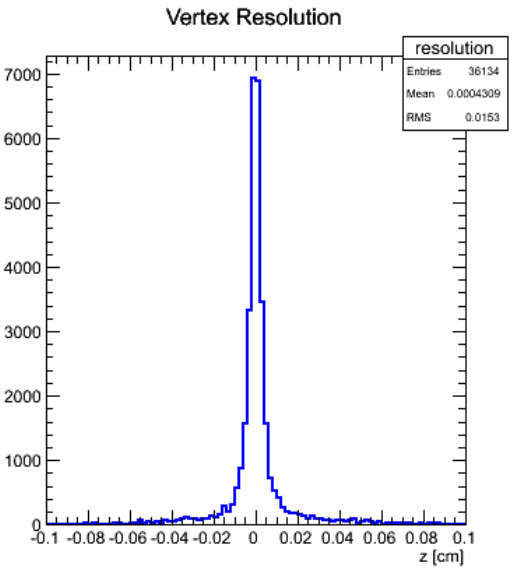






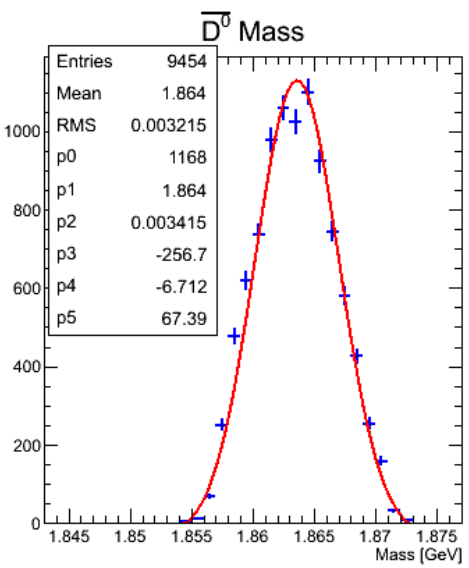


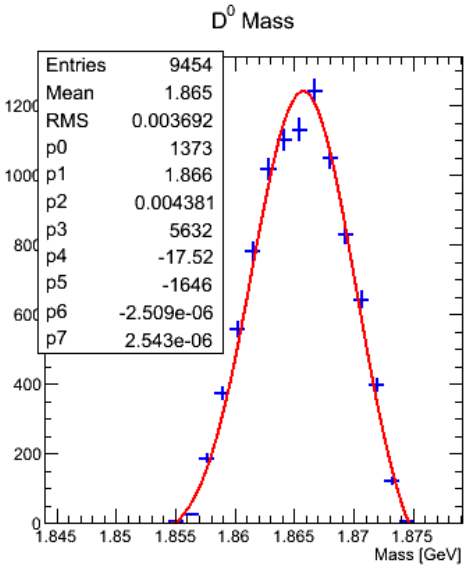


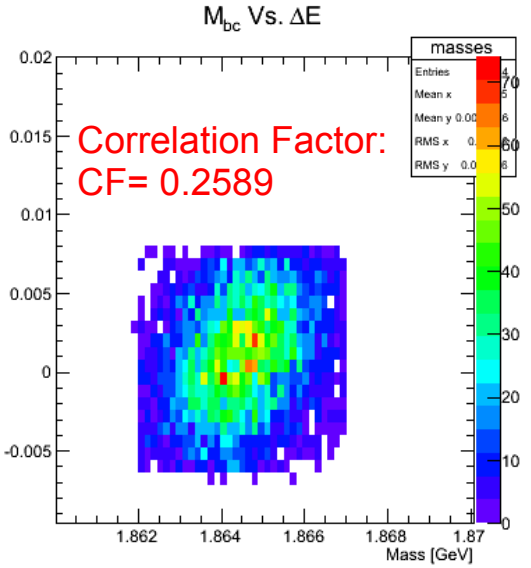


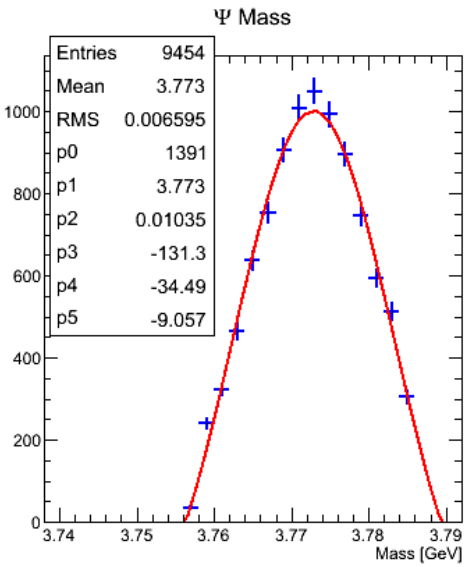
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+ e^- \overline{\nu}_e)(\pi^+\pi^-)[\beta\gamma = 0.23]$$

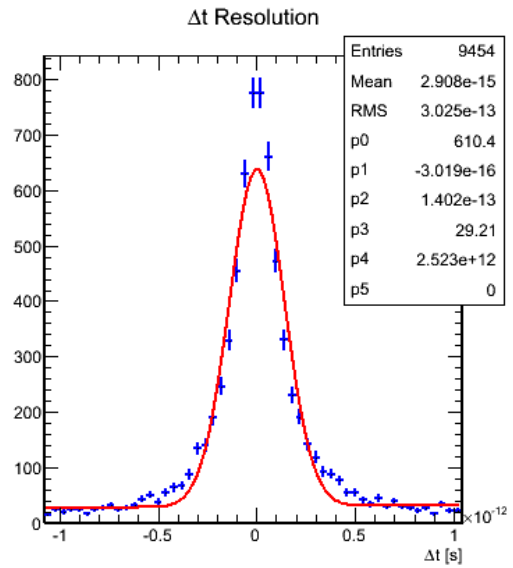
Missing ν reconstructed + small background

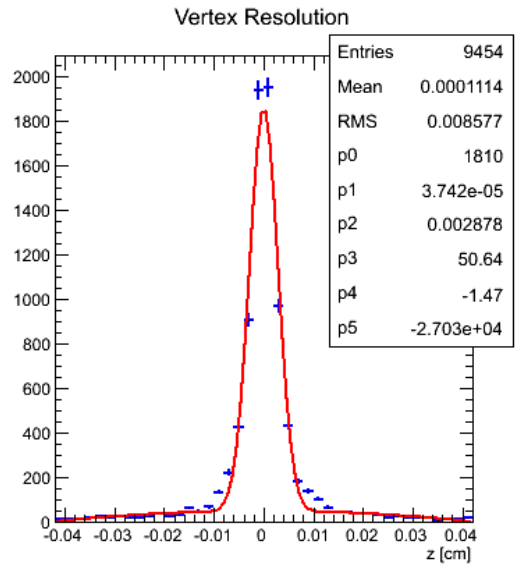




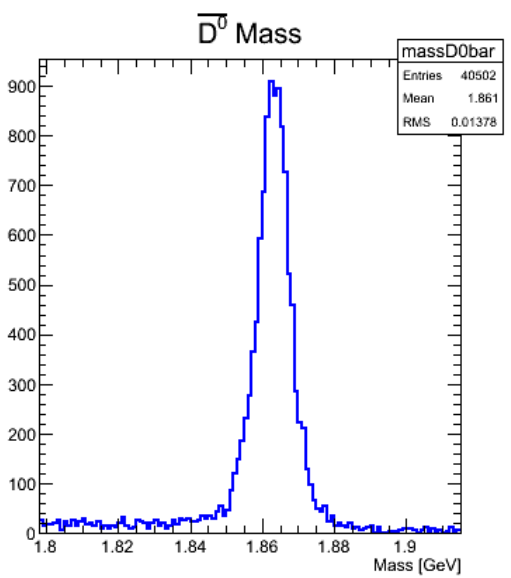


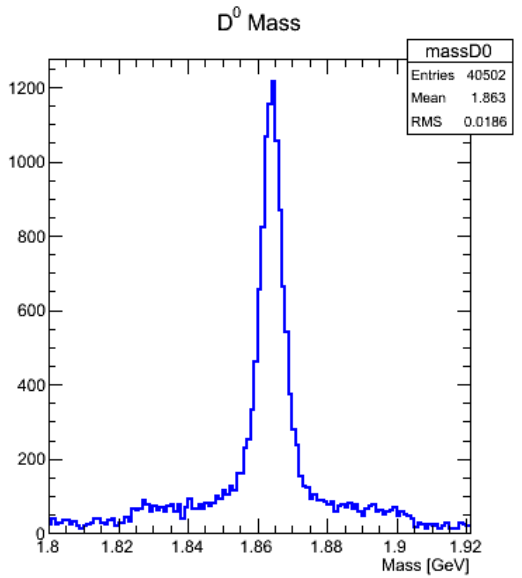


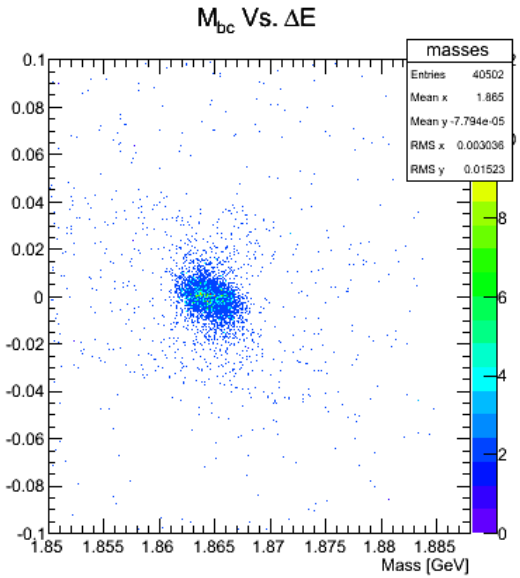


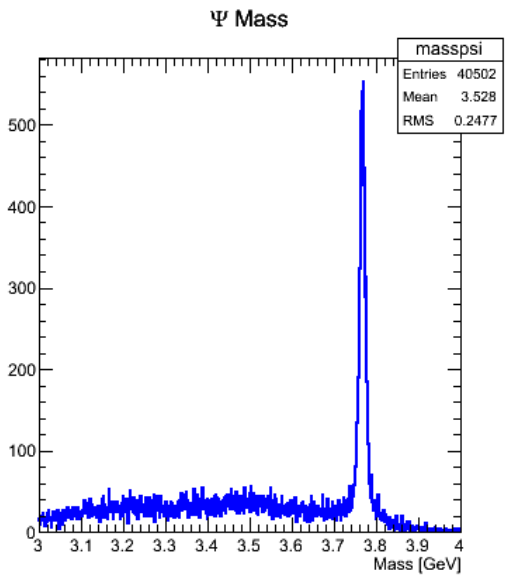


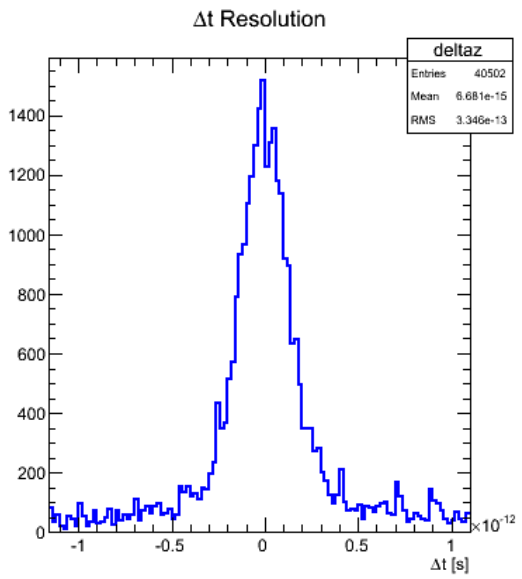
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+K^-)(\pi^+\pi^-)[\beta\gamma = 0.9]$$

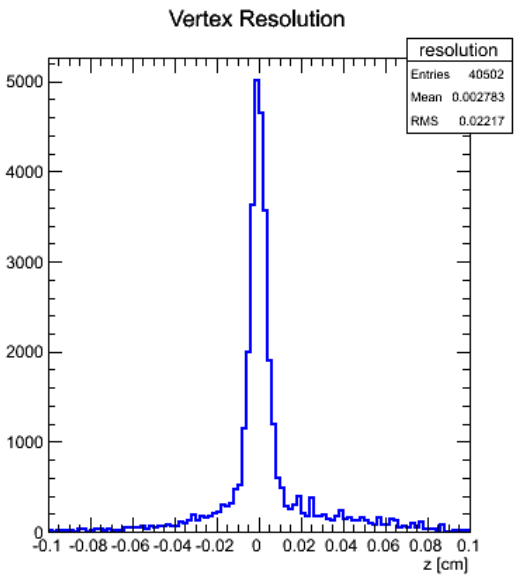




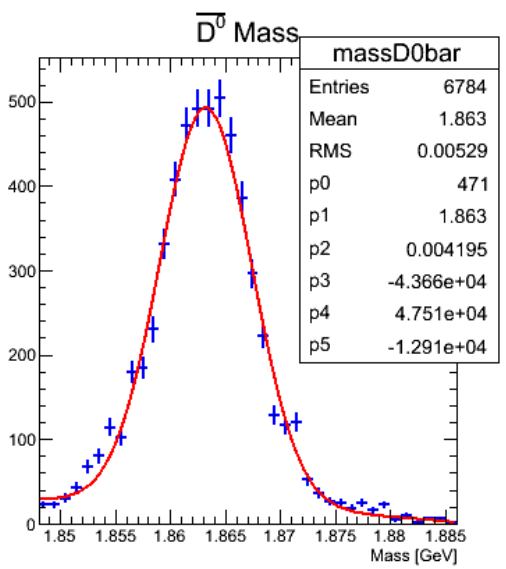


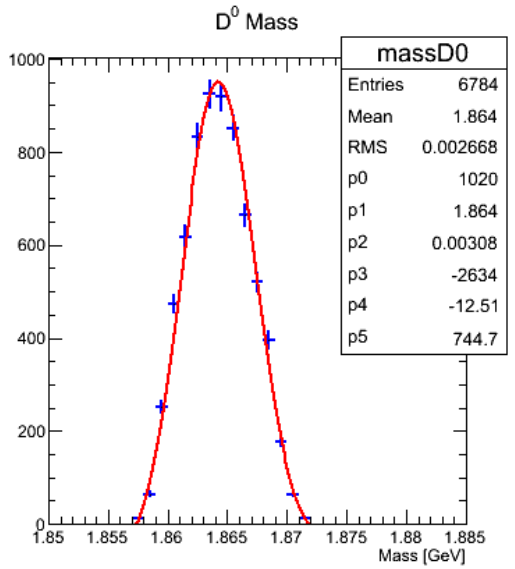


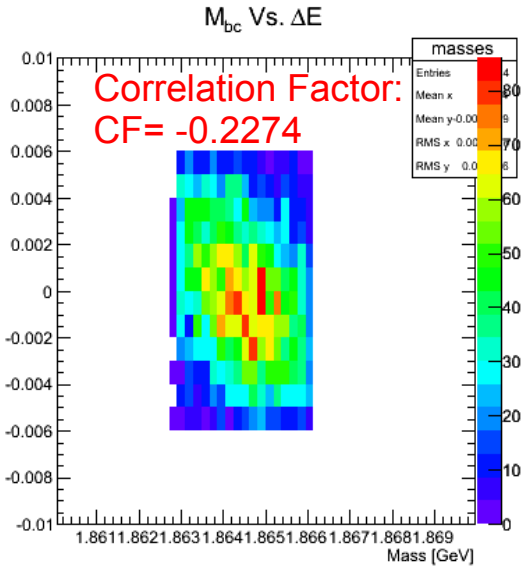


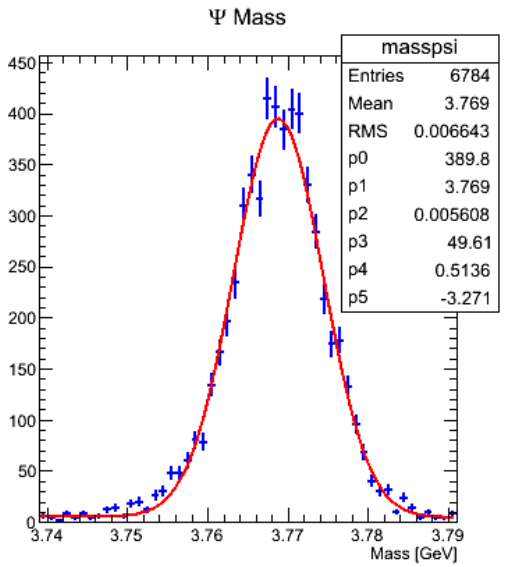


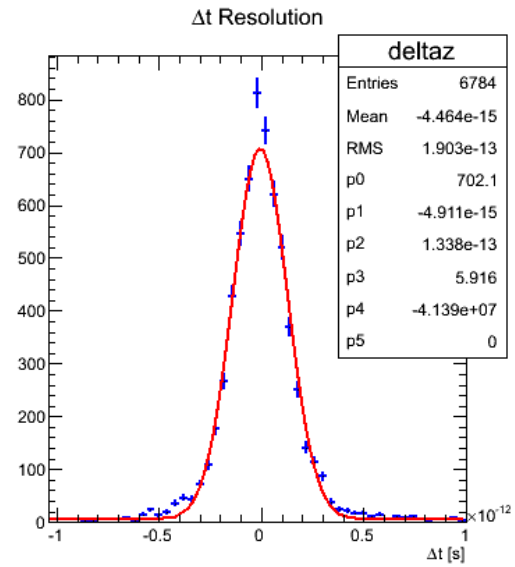
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+K^-)(\pi^+\pi^-)[\beta\gamma = 0.9]$$

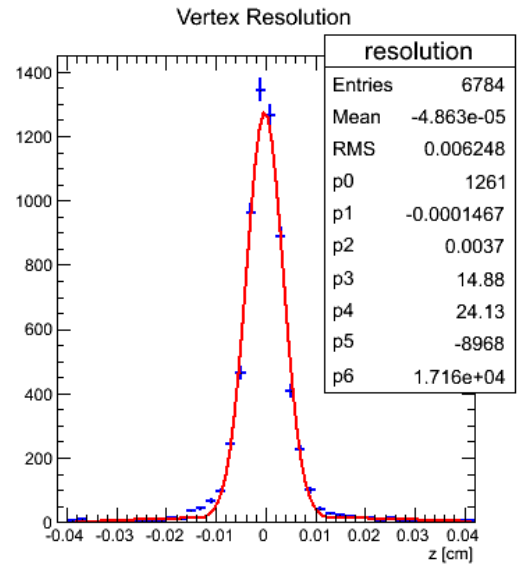




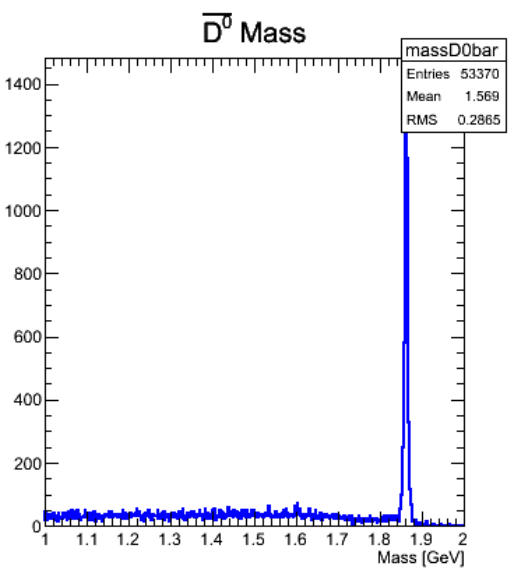


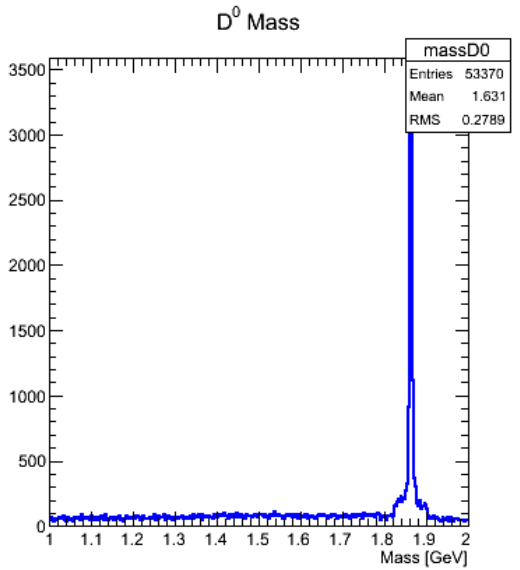


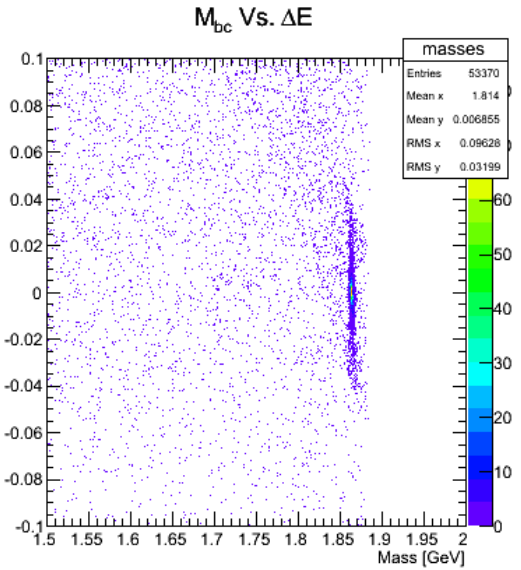


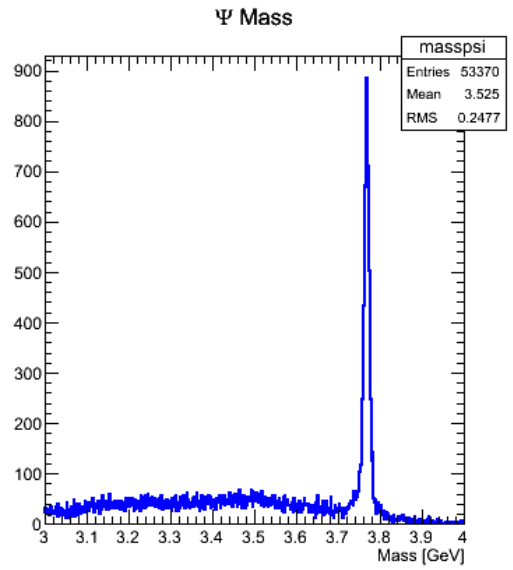


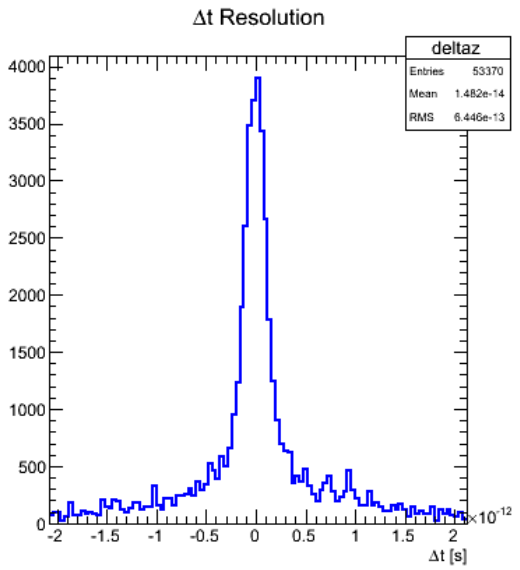
$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+K^-)(\pi^+\pi^-)[\beta\gamma = 0.23]$$

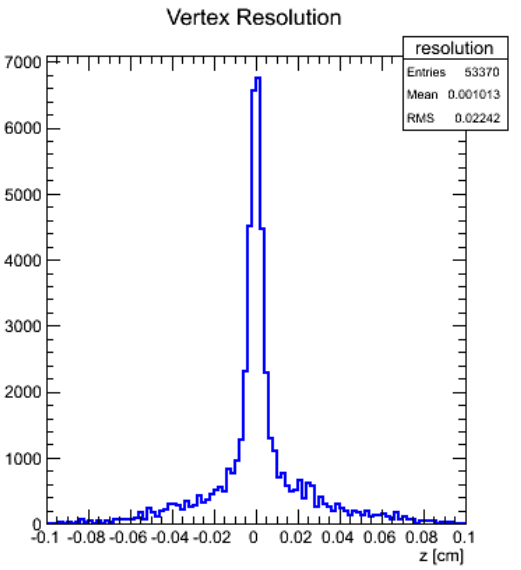












$$e^+e^- \to \Psi(3770) \to (D^0)(\overline{D^0}) \to (K^+K^-)(\pi^+\pi^-)[\beta\gamma = 0.23]$$